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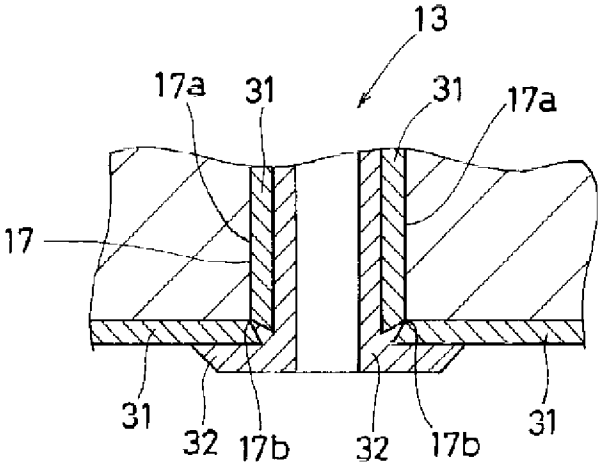
(54)【発明の名称】　プラズマＣＶＤ装置

(57)【要約】
【課題】　パーティクルの発生を防止し、かつフッ素を含有しない薄膜を形成して電気的特性の良好な半導体デバイスを製造できるプラズマＣＶＤ装置を提供する。
【解決手段】　プラズマＣＶＤ装置は、反応室内部に対向配置されたシャワープレート電極１３、ステージ電極を備え、その電極間に高周波電圧を印加しながら原料ガスを導入して、基板上に成膜を行う。シャワープレート電極１３の全面にアルミナ膜３１が形成されるので、フッ素による腐食が発生しにくく、パーティクルの発生を防止することができる。フッ素が付着し易い噴出孔１７の内面１７ａのアルミナ膜３１上にニッケル膜３２が形成されるので、フッ素の付着を防止することができる。



【特許請求の範囲】
【請求項１】　反応室内部に対向配置された複数の電極を備え、その電極間に高周波電圧を印加しながら原料ガスを導入して、基板上に成膜を行うプラズマＣＶＤ装置において、
電極は原料ガスを反応室内に噴出する噴出孔を有し、電極の全面にアルミナ膜が形成され、噴出孔の内面のアルミナ膜上にニッケル膜が形成されていることを特徴とするプラズマＣＶＤ装置。
【請求項２】　前記ニッケル膜は、噴出孔の開口部およびその周辺のアルミナ膜を覆うことを特徴とする請求項１記載のプラズマＣＶＤ装置。
【発明の詳細な説明】
【０００１】
【発明の属する技術分野】本発明は、半導体デバイスなどを製造するために、高エネルギーのガスプラズマ状態でＣＶＤ（Chemical Vaper Deposition）法による薄膜形成を行うプラズマＣＶＤ装置に関する。
【０００２】
【従来の技術】従来のプラズマＣＶＤ装置は、図１に示すプラズマＣＶＤ装置１０と同様に、反応室、電源、シャワープレート電極およびステージ電極などを備えており、ステージ電極上に基板を乗載して、ステージ電極とシャワープレート電極との間に高周波電圧を印加しながらSiH_4などの原料ガスを導入することによって、基板の表面にａ－Ｓｉ（アモルファスシリコン）などの薄膜を形成する。
【０００３】また、従来のプラズマＣＶＤ装置は、プラズマクリーニングによって反応室内の電極などに付着した不要な膜を除去している。プラズマクリーニングとは、原料ガスの代わりに、NF_3などのフッ素化合物から成るクリーニングガスを反応室内に導入し、エッチングによって不要な膜を除去する方法である。
【０００４】図３は、従来のプラズマＣＶＤ装置のシャワープレート電極１の構造を示す断面図である。シャワープレート電極１は、中空構造を有し、原料ガスを噴出するための噴出孔２を有する。また、噴出孔２の内面２ａおよび開口部２ｂを含むシャワープレート電極１の全面が、表面処理によって形成されたアルミナ膜３によって覆われる。
【０００５】特開平８－１４４０６０に記載されるように、シャワープレート電極１の材料としては、アルミニウム、ステンレスまたはニッケルが使用される。アルミナ膜３の代わりにアルミニウム膜が使用されることもある。
【０００６】
【発明が解決しようとする課題】図３に示したように、シャワープレート電極１の表面にアルミナ膜３を形成した場合、プラズマクリーニングによって、噴出孔２の内面２ａを覆うアルミナ膜３に比較的多量のフッ素が付着する。すなわち、アルミナ（Al_2O_3）は微視的には多孔質であって表面積が大きいので、フッ素を吸着し易く、特に、クリーニングガスが通過する噴出孔２の内面２ａを覆うアルミナ膜３には、多量のフッ素が付着する。
【０００７】プラズマクリーニングを行った後、反応室において成膜を行うと、噴出孔２の内面２ａを覆うアルミナ膜３に付着していたフッ素が、原料ガスとともに反応室に導入され、基板上に成膜される薄膜中に不純物として取り込まれてしまう。このような成膜によってダイオードおよびトランジスタなどの半導体デバイスを製造すると、半導体デバイスの電気的特性に悪影響を与えることがある。
【０００８】一方、アルミナ膜３の代わりにアルミニウム膜を形成した場合、プラズマクリーニングによって、アルミニウム膜が腐食して、パーティクルを発生させる。パーティクルは、成膜された薄膜に落下して、薄膜を変形させ、半導体デバイス回路に欠陥を発生させることがある。また、シャワープレート電極１に表面処理を加えない場合も、プラズマクリーニングによって、電極表面が腐食し、パーティクルを発生させ、半導体デバイス回路に欠陥を発生させることがある。
【０００９】本発明の目的は、パーティクルの発生を防止し、かつフッ素を含有しない薄膜を形成して、電気的特性の良好な半導体デバイスを製造できるプラズマＣＶＤ装置を提供することである。
【００１０】
【課題を解決するための手段】本発明は、反応室内部に対向配置された複数の電極を備え、その電極間に高周波電圧を印加しながら原料ガスを導入して、基板上に成膜を行うプラズマＣＶＤ装置において、電極は原料ガスを反応室内に噴出する噴出孔を有し、電極の全面にアルミナ膜が形成され、噴出孔の内面のアルミナ膜上にニッケル膜が形成されていることを特徴とするプラズマＣＶＤ装置である。
【００１１】本発明に従えば、フッ素が付着し易い噴出孔の内面アルミナ膜を、フッ素による腐食が少なく多孔質ではないニッケル膜で覆うので、フッ素の付着を防止でき、フッ素を含有しない薄膜を形成することができる。また、電極はアルミナ膜およびニッケル膜によって覆われるので、フッ素による腐食が発生しにくく、パーティクルの発生を防止することができる。よって、電気的特性の良好な半導体デバイスを製造することができる。
【００１２】また本発明は、前記ニッケル膜は、噴出孔の開口部およびその周辺のアルミナ膜を覆うことを特徴とする。
【００１３】本発明に従えば、電極の全面を覆うアルミナ膜のうち、曲がった形状によって亀裂が発生し易い噴出孔の開口部およびその周辺までをもニッケル膜で覆う

ので、フッ素による腐食を確実に防止することができる。よって、パーティクルの発生を防止して、さらに電気的特性の良好な半導体デバイスを製造することができる。

【００１４】

【発明の実施の形態】図１は、本発明の一実施形態であるプラズマＣＶＤ装置１０を示す図である。プラズマＣＶＤ装置１０は、平行平板電極型のＣＶＤ装置であり、反応室１１、電源１２、シャワープレート電極１３およびステージ電極１４などを備える。

【００１５】反応室１１には上壁１１ａを貫通するように吸気管１５が設けられ、下壁１１ｂに開口する排気管１６が接続される。反応室１１には、吸気管１５を介してガスが導入され、図示されないポンプによって排気管１６を介して、反応室１１内のガスが排出される。

【００１６】シャワープレート電極１３およびステージ電極１４は、アルミニウムなどの金属から成る平板状の電極であり、互いに平行に上下に対向して反応室１１内に配置される。上側のシャワープレート電極１３は、吸気管１５に接続される内部空間１３ａを有し、シャワープレート電極１３の下壁１３ｂには、内部空間１３ａからガスを噴出するための複数の噴出孔１７が形成されている。噴出孔１７は、面状に分散配置されており、基板Ｍの表面に対して均一に原料ガスを噴出することができる。下側のステージ電極１４は、その上面１４ａに基板Ｍを乗載し、ステージ電極１４には乗載された基板Ｍを一定温度に保持するためのヒータ１８が埋め込まれている。

【００１７】電源１２は、１３．５６ＭＨｚの高周波の電力を供給する電源であり、一端はシャワープレート電極１３に接続され、他端は接地される。ステージ電極１４も接地されており、電源１２は、シャワープレート電極１３とステージ電極１４との間に所定の電圧レベルの高周波電圧を印加することができる。シャワープレート電極１３とステージ電極１４との間に電圧が印加されることによって、原料ガスは、高エネルギーのプラズマ状態となる。

【００１８】基板Ｍ上に薄膜を形成するときには、反応室１１には、薄膜の原料となる原料ガスが導入される。原料ガスは、SiH_4、NH_3、H_2、N_2、N_2O、O_2、Ａｒ、ＴＥＯＳ（テトラメチルオルソシリケート）などである。このうち少なくとも１種類のガスが反応室１１に導入され、これらが化学反応を起こすことによって、基板Ｍ上にａ－Ｓｉ、n^+－ａ－Ｓｉ、ＳｉＮｘ、SiO_2などの薄膜が形成される。

【００１９】たとえば、ａ－Ｓｉ薄膜を形成するためには、原料ガスとしてSiH_4、H_2およびＡｒのうちいくつかを反応室１１に導入し、ＳｉＮｘ薄膜を形成するためには、SiH_4、NH_3、H_2およびN_2のうちいくつかを導入し、SiO_2薄膜を形成するためには、SiH_4、N_2O、O_2、ＡｒおよびＴＥＯＳのうちいくつかを導入する。なお、n^+－ａ－Ｓｉは、ｎ型の不純物を多量に含有するａ－Ｓｉである。

【００２０】また、図１のプラズマＣＶＤ装置１０は、吸気管１５の途中に設けられた励起室２１およびマイクロ波発生機２２から成るクリーニング機構を備えている。クリーニング機構は、反応室１１内に付着した不要な膜を除去する。以下、不要な膜の除去の手順を説明する。

【００２１】まず、反応室１１への原料ガスの導入を中止して、吸気管１５を介して励起室２１にクリーニングガスを導入する。クリーニングガスは、NF_3、CF_4またはSF_6などのフッ素化合物である。次に、励起室２１において、マイクロ波発生機２２からのマイクロ波をクリーニングガスに照射することによって、これを励起する。励起されたクリーニングガスは、フッ素ラジカルを含み、反応室１１に導入されて、反応室１１内に付着したａ－Ｓｉ、n^+－ａ－Ｓｉ、ＳｉＮｘ、SiO_2などの膜と反応して、その膜を除去する。

【００２２】図２は、図１のシャワープレート電極１３の構造を示す断面図である。シャワープレート電極１３の全面にアルミナ膜３１が形成され、噴出孔１７の内面１７ａのアルミナ膜３１上にニッケル膜３２が形成されている。噴出孔１７は、多量のクリーニングガスが通過する部分であり、内面１７ａ上にアルミナ膜３１が露出していると、フッ素が付着し易いが、これをニッケル膜３２で覆うことによって、フッ素の付着を防止することができる。

【００２３】また、ニッケル膜３２は、噴出孔１７の開口部１７ｂおよびその周辺のアルミナ膜３１をも覆うように形成されている。シャワープレート電極１３の全面を覆うアルミナ膜３１のうち、特に、噴出孔１７の開口部１７ｂを覆う部分は、曲がった形状によって亀裂が発生し易いが、これをニッケル膜３２で覆い、さらに開口部１７ｂの周辺までをもニッケル膜３２で覆うので、フッ素による腐食を確実に防止することができる。

【００２４】

【発明の効果】以上のように本発明によれば、噴出孔の内面をニッケル膜で覆うことによって、フッ素を含有しない薄膜を形成し、かつパーティクルの発生を防止して、電気的特性の良好な半導体デバイスを製造することができる。

【００２５】また本発明によれば、噴出孔の開口部およびその周辺のアルミナ膜をニッケル膜で覆うことによって、フッ素による腐食を確実に防止して、さらに電気的特性の良好な半導体デバイスを製造することができる。

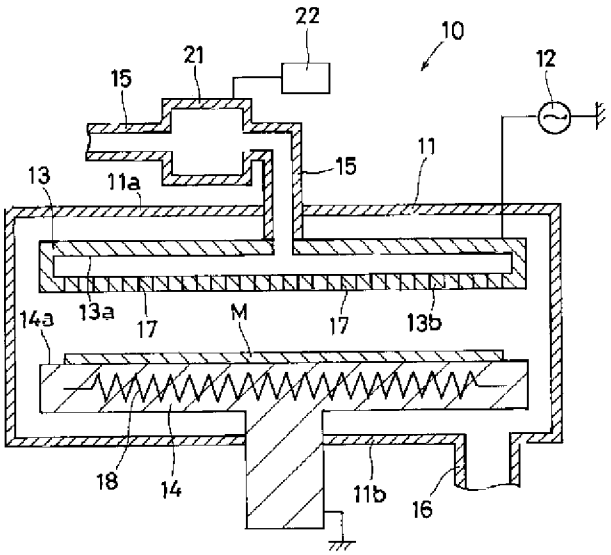
【図面の簡単な説明】

【図１】本発明の一実施形態であるプラズマＣＶＤ装置１０の構成を示す図である。

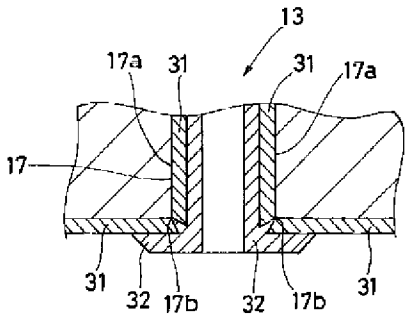
【図２】図１のシャワープレート電極１３の構造を示す

断面図である。
【図３】従来のプラズマＣＶＤ装置のシャワープレート電極１を示す断面図である。
【符号の説明】
１０　プラズマＣＶＤ装置
１１　反応室
１２　電源
１３　シャワープレート電極
１４　ステージ電極
１５　吸気管
１６　排気管
１７　噴出孔
１７ａ　内面
１７ｂ　開口部
１８　ヒータ
３１　アルミナ膜
３２　ニッケル膜

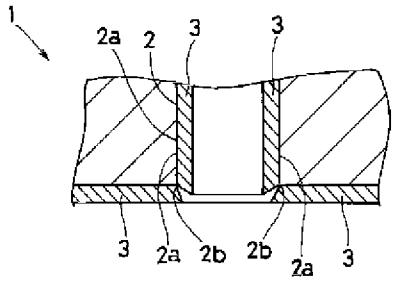
【図１】



【図２】



【図３】



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AA18 BA30 BA40 BA44 FA03
KA17 KA30 KA47
5F045 AA08 AA09 AB04 AB32 AB33
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BB15 BB16 EB06 EF05 EH04
EH05 EH08 EH14 EK07

Partial English Translation of

LAID OPEN unexamined

JAPANESE PATENT APPLICATION

Publication No. 2000-138169

(57) [Abstract]
[Object] The object of the present invention is to provide a plasma CVD system by which a semiconductor device having excellent electrical characteristics can be manufactured, in which generation of particles is prevented and a thin film containing no fluorine is formed.
[Means for Solving the Problem] The plasma CVD system includes a shower plate electrode 13 and a stage electrode 14 which are arranged in mutually opposing relation in a reaction chamber. In the plasma CVD system, a film is formed on a substrate by introducing a source gas while applying a high frequency voltage between the electrodes. Since an alumina film 31 is formed on the entire surface of the shower plate electrode 13, corrosion due to fluorine is not easily caused and particle generation can be prevented. Since a nickel film 32 is formed on the alumina film 31, to which fluorine is likely to adhere, on an inner surface 17a of an exhaust hole 17, adhesion of fluorine can be prevented.

[0004] to [0007]
[0004] Figure 3 is a cross-sectional view showing the structure of a shower plate electrode 1 in the conventional plasma CVD system. The shower plate electrode 1 has a hollow inside and is provide with an exhaust hole 2 for exhausting a source gas. Further, an alumina film 3 formed by surface treating covers the entire surface of the shower plate electrode 1, which includes an inner surface 2a and an opening 2b of the exhaust hole 2.
[0005] As disclosed in the Japanese Patent Laid-Open Publication No. 08-144060, aluminum, stainless or nickel is used as the material of the shower plate 1. An aluminum film is used instead of the alumina film 3 in some cases.
[0006]
[PROBLEM TO BE SOLVED BY THE INVENTION] When the alumina film 3 is formed on the surface of the shower plate electrode 1, as show in Figure 3, a relatively large amount of fluorine adheres to the alumina film

3 covering the inner surface 2a of the exhaust hole 2, as a result of plasma cleaning. More specifically, since alumna (Al_2O_3) is porous on a microscopic level and the surface area thereof is large, fluorine is easily adsorbed thereto. In particular, a large amount of fluorine adheres to the alumina film 3 covering the inner surface 2a of the exhaust hole 2 through which the cleaning gas passes.

[0007] When film formation is performed after plasma cleaning is carried out, the fluorine adhering to the alumina film 3 covering the inner surface 2a of the exhaust hole 2 is introduced into the reaction chamber along with the source gas and is incorporated as an impurity into a thin film to be formed on the substrate. When semiconductor devices such as diodes and transistors are formed using such a film formation method, the electric characteristics of the semiconductor devices are adversely affected in some cases.

[0022] to [0023]

[0022] Figure 2 is a cross-sectional view showing the structure of the shower plate electrode 13. An alumina film 31 is formed on the entire surface of the shower plate electrode 13 and a nickel film 32 is formed on the alumina film 31 on the inner surface 17a of the exhaust hole 17. Since a large amount of cleaning gas passes though the exhaust hole 17, fluorine is very likely to adhere to alumina film 31 in a case where the alumina film 31 is exposed on the inner surface 17a. However, by covering the alumina film 31 with a nickel film 32, the fluorine can be prevented from adhering.

[0023] Further, the nickel film 32 is so formed as to cover the alumina film 31 on an opening 17b of the exhaust hole 17 and the region in the vicinity thereof. The specific part of the alumna film 31 covering the entire surface of the shower plate electrode 13, which covers the opening 17b of the exhaust hole 17, is bent in shape and therefore cracking is likely to occur in this part. To solve this problem, not only the aforementioned specific part but also the part in the vicinity of the opening 17b are covered with the nickel film 32 so that corrosion due to fluorine can be completely prevented.

PATENT ABSTRACTS OF JAPAN

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(21)Application number : 10-308993 (71)Applicant : SHARP CORP

(22)Date of filing : 29.10.1998 (72)Inventor : TSUKAMOTO TAKASHI

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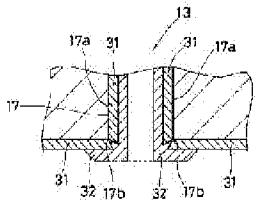
(54) PLASMA CVD DEVICE



(57)Abstract:

PROBLEM TO BE SOLVED: To provide a plasma CVD device capable of preventing occurrence of particles and also forming a thin film not containing

fluorine to manufacture a semiconductor device superior in electric characteristics.

SOLUTION: This plasma CVD device comprises a shower plate electrode 13 and a stage electrode which are disposed counter to each other inside a reaction chamber, and a high frequency voltage is applied on between the electrodes, while a raw material gas is led thereinto, to form a film on a substrate. As an alumina film 31 is formed on the entire face of the shower plate electrode 13, erosion is hard to occur due to fluorine, and occurrence of particles can be prevented. As a nickel film 32 is formed on the alumina film 31 on an inner face 17a of a jet hole 17 onto which fluorine is easy to adhere, it is possible to prevent fluorine from adhering thereto.

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CLAIMS

[Claim(s)]

[Claim 1] It is plasma-CVD equipment characterized by to equip the interior of a reaction chamber with two or more electrodes by which opposite arrangement was carried out, to introduce material gas, impressing high-frequency voltage to inter-electrode [the], for an electrode to have the jet hole which spouts material gas in a reaction chamber, to form the alumina film all over an electrode in the plasma-CVD equipment which forms membranes on a substrate, and to form the nickel film on the alumina film of the inside of a jet hole.

[Claim 2] Said nickel film is plasma-CVD equipment according to claim 1 characterized by covering opening of a jet hole, and the alumina film of the circumference of it.

[Translation done.]

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DETAILED DESCRIPTION

[Detailed Description of the Invention]

[0001]

[Field of the Invention] in order that this invention may manufacture a semiconductor device etc. -- the gas plasma state of high energy -- CVD (Chemical Vaper Deposition) -- it is related with the plasma-CVD equipment which performs thin film formation by law.

[0002]

[Description of the Prior Art] Like the plasma-CVD equipment 10 shown in drawing 1 , conventional plasma-CVD equipment is equipped with the reaction chamber, the power source, the shower plate electrode, the stage electrode, etc., **** a substrate on a stage electrode, and it forms thin films, such as a-Si (amorphous silicon), on the surface of a substrate by introducing material gas, such as SiH4, impressing high-frequency voltage between a stage electrode and a shower plate electrode.

[0003] Moreover, conventional plasma-CVD equipment has removed the unnecessary film which adhered to the electrode in a reaction chamber etc. by plasma cleaning. Plasma cleaning is the approach introduce the cleaning gas which consists of fluorine compounds, such as NF3, in a reaction chamber instead of material gas, and etching removes the unnecessary film.

[0004] Drawing 3 is the sectional view showing the structure of the shower plate electrode 1 of conventional plasma-CVD equipment. The shower plate electrode 1 has hollow structure, and has the jet hole 2 for spouting material gas. Moreover, the whole surface of the shower plate electrode 1 containing inside 2a of the jet hole 2 and opening 2b is covered with the alumina film 3 formed of surface treatment.

[0005] As an ingredient of the shower plate electrode 1, aluminum, stainless steel, or nickel is used so that it may be indicated by JP,8-144060,A. The aluminum film may be used instead of the alumina film 3.

[0006]

[Problem(s) to be Solved by the Invention] As shown in drawing 3 , when the alumina film 3 is formed in the front face of the shower plate electrode 1, comparatively a lot of fluorines adhere inside 2a of the jet hole 2 to the wrap alumina film 3 by plasma cleaning. That is, an alumina (aluminum 2O3) is porosity microscopically, since surface area is large, it is easy to adsorb a fluorine and a lot of fluorines adhere inside 2a of the jet hole 2 which cleaning gas passes especially to the wrap alumina film 3.

[0007] If membranes are formed in a reaction chamber after performing plasma cleaning, the fluorine which had adhered inside 2a of the jet hole 2 to the wrap alumina film 3 will be introduced into a reaction chamber with material gas, and will be incorporated as an impurity in the thin film formed on a substrate. When semiconductor devices, such as diode and a transistor, are manufactured by such membrane formation, it may have a bad influence on the electrical characteristics of a semiconductor device.

[0008] On the other hand, when the aluminum film is formed instead of the alumina film 3, by plasma cleaning, the aluminum film corrodes and particle is generated. Particle falls to the formed thin film, is made to deform a thin film, and may make a semiconductor device circuit generate a defect. Moreover, also when not adding surface treatment to the shower plate electrode 1, an electrode surface corrodes, particle is generated and a semiconductor device circuit may be made to generate a defect by plasma cleaning.

[0009] The purpose of this invention is offering the plasma-CVD equipment which forms the thin film which prevents generating of particle and does not contain a fluorine, and can manufacture the good semiconductor device of electrical characteristics.

[0010]

[Means for Solving the Problem] It is plasma-CVD equipment characterized by for this invention to equip the interior of a reaction chamber with two or more electrodes by which opposite arrangement was carried out, to introduce material gas, impressing high-frequency voltage to inter-electrode [the], for an electrode to have the jet hole which spouts material gas in a reaction chamber in the plasma-CVD equipment which forms membranes on a substrate, to form the alumina film all over an electrode, and to be formed the nickel film on the alumina film of the inside of a jet hole.

[0011] If this invention is followed, by the nickel film which is not porosity few, by that of a wrap, the corrosion according the inside alumina film of the jet hole to which a fluorine tends to adhere to a fluorine can prevent adhesion of a fluorine, and can form the thin film which does not contain a fluorine. Moreover, since an electrode is covered with the alumina film and the nickel film, it is hard to generate the corrosion by the fluorine, and it can prevent generating of particle. Therefore, the good semiconductor device of electrical characteristics can be manufactured.

[0012] Moreover, this invention is characterized by said nickel film covering opening of a jet hole, and the alumina film of the circumference of it.

[0013] If this invention is followed, the corrosion according even opening of the jet hole which a crack tends to generate with the configuration which turned at the whole surface of an electrode among wrap alumina film, and its circumference to a fluorine can be certainly prevented by that of a wrap by the nickel film. Therefore, generating of particle can be prevented and a semiconductor device with still better electrical characteristics can be manufactured.

[0014]

[Embodiment of the Invention] Drawing 1 is drawing showing the plasma-CVD equipment 10 which is 1 operation gestalt of this invention. Plasma-CVD equipment 10 is a CVD system of an parallel plate electrode mold, and is equipped with a reaction chamber 11, a power source 12, the shower plate

electrode 13, the stage electrode 14, etc.

[0015] An inlet pipe 15 is formed in a reaction chamber 11 so that upper wall 11a may be penetrated, and the exhaust pipe 16 which carries out opening to low wall 11b is connected. Gas is introduced into a reaction chamber 11 through an inlet pipe 15, and the gas in a reaction chamber 11 is discharged through an exhaust pipe 16 with the pump which is not illustrated.

[0016] The shower plate electrode 13 and the stage electrode 14 are plate-like electrodes which consist of metals, such as aluminum, counter parallel up and down mutually, and are arranged in a reaction chamber 11. The upper shower plate electrode 13 has building envelope 13a connected to an inlet pipe 15, and two or more jet holes 17 for spouting gas from building envelope 13a are formed in low wall 13b of the shower plate electrode 13. The jet hole 17 is distributed in the shape of a field, and can spout material gas to homogeneity to the front face of Substrate M. The lower stage electrode 14 **** Substrate M to the top-face 14a, and the heater 18 for holding the ****(ed) substrate M to constant temperature is embedded at the stage electrode 14.

[0017] A power source 12 is a power source which supplies the power of a 13.56MHz RF, an end is connected to the shower plate electrode 13, and the other end is grounded. The stage electrode 14 is also grounded and a power source 12 can impress the high-frequency voltage of a predetermined voltage level between the shower plate electrode 13 and the stage electrode 14. By impressing an electrical potential difference between the shower plate electrode 13 and the stage electrode 14, material gas will be in the plasma state of high energy.

[0018] When forming a thin film on Substrate M, the material gas used as the raw material of a thin film is introduced into a reaction chamber 11. Material gas is SiH4, NH3, H2, N2, N2O, O2 and Ar, TEOS (tetramethyl orthochromatic silicate), etc. Among these, at least one kind of gas is introduced into a reaction chamber 11, and when these cause a chemical reaction, thin films, such as a-Si, n+-a-Si, SiNx, and SiO2, are formed on Substrate M.

[0019] For example, in order to introduce some among SiH4, NH3, H2, and N2 in order to introduce some into a reaction chamber 11 among SiH4, H2, and Ar as material gas in order to form an a-Si thin film, and to form a SiNx thin film, and to form SiO2 thin film, some are introduced among SiH4, N2O, O2 and Ar, and TEOS. In addition, n+-a-Si is a-Si which contains the impurity of n mold so much.
[0020] Moreover, the plasma-CVD equipment 10 of drawing 1 is equipped with the cleaning device which consists of the excitation room 21 prepared in the middle of and the microwave generating machine 22. [an inlet pipe 15] A cleaning device removes the unnecessary film which adhered in the reaction chamber 11. Hereafter, the procedure of removal of the unnecessary film is explained.
[0021] First, installation of the material gas to a reaction chamber 11 is stopped, and cleaning gas is introduced into the excitation room 21 through an inlet pipe 15. Cleaning gas is fluorine compounds, such as NF3, CF4, or SF6. Next, at the excitation room 21, this is excited by irradiating the microwave from the microwave generating machine 22 at cleaning gas. Including a fluorine radical, the excited cleaning gas is introduced into a reaction chamber 11, reacts with film, such as a-Si which adhered in the reaction chamber 11, n+-a-Si, SiNx, and SiO2, and removes the film.
[0022] Drawing 2 is the sectional view showing the structure of the shower plate electrode 13 of drawing 1 . The alumina film 31 is formed all over the shower plate electrode 13, and the nickel film 32 is formed on the alumina film 31 of inside 17a of the jet hole 17. The jet hole 17 can prevent adhesion of a fluorine by covering this by the nickel film 32, although it is the part which a lot of cleaning gas passes, and a fluorine will tend to adhere if the alumina film 31 is exposed on inside 17a.
[0023] Moreover, the nickel film 32 is formed so that opening 17b of the jet hole 17 and the alumina film 31 of the circumference of it may also be covered. Although a crack tends to generate the whole surface of the shower plate electrode 13 among the wrap alumina film 31 with the configuration where

especially the wrap part turned at opening 17b of the jet hole 17, this is covered by the nickel film 32, further, it is that of a wrap by the nickel film 32 even about the circumference of opening 17b, and the corrosion by the fluorine can be prevented certainly.

[0024]

[Effect of the Invention] As mentioned above, according to this invention, by covering the inside of a jet hole by the nickel film, the thin film which does not contain a fluorine can be formed, and generating of particle can be prevented, and the good semiconductor device of electrical characteristics can be manufactured.

[0025] Moreover, according to this invention, by covering opening of a jet hole, and the alumina film of the circumference of it by the nickel film, the corrosion by the fluorine can be prevented certainly and a semiconductor device with still better electrical characteristics can be manufactured.

[Translation done.]

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DESCRIPTION OF DRAWINGS

[Brief Description of the Drawings]

[Drawing 1] It is drawing showing the configuration of the plasma-CVD equipment

10 which is 1 operation gestalt of this invention.

[Drawing 2] It is the sectional view showing the structure of the shower plate electrode 13 of drawing 1 .

[Drawing 3] It is the sectional view showing the shower plate electrode 1 of conventional plasma-CVD equipment.

[Description of Notations]

10 Plasma-CVD Equipment

11 Reaction Chamber

12 Power Source

13 Shower Plate Electrode

14 Stage Electrode

15 Inlet Pipe

16 Exhaust Pipe

17 Jet Hole

17a Inside

17b Opening

18 Heater

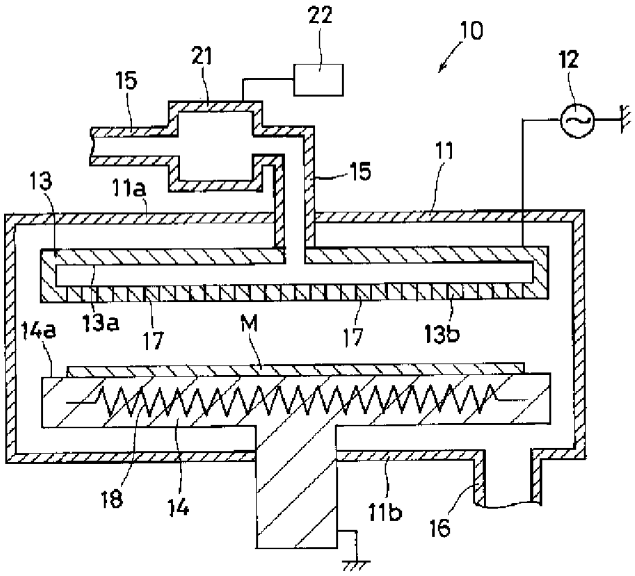
31 Alumina Film

32 Nickel Film

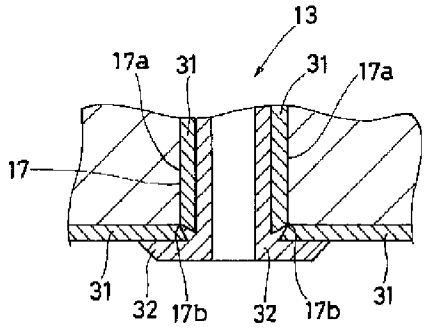
[Translation done.]

DRAWINGS

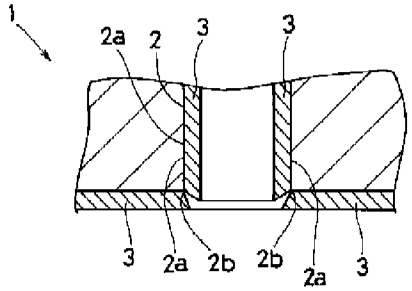
[Drawing 1]



[Drawing 2]



[Drawing 3]



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